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**EP 0 755 656 A2**

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## EUROPEAN PATENT APPLICATION

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• **Hill, Donald G.**  
**Hopatcong, NJ 07843 (US)**

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(72) Inventors:  
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(54) **One-way suture retaining device for braided sutures**

(57) A one-way adjustable suture retaining device suitable for use in arthroscopic surgery to secure one end of a braided suture comprising a frustum having an end and a base wherein a passage extends from the

end to the base and the end has a plurality of slits extending from the end towards the base defining at least two flexible fingers and a process for using the retaining device to secure at least one end of a suture.

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## Description

### Field of the Invention

This invention relates to a surgical device for retaining braided sutures. More particularly, this invention relates to a one-way adjustable suture retaining device suitable for use in arthroscopic surgery.

### Background of the Invention

Surgeons often must attach ligaments to bone, soft tissue to bone, or repair tears in ligaments in arthroscopic surgery. They prefer to use a suture to do this because of its small size and adequate strength. Surgeons secure the suture in place by tying knots with multiple throws. However, it is often difficult to tie knots arthroscopically because of the lack of access and limited visibility. Many of these procedures depend on extracorporal knotting to circumvent these difficulties. Unfortunately, extracorporal knotting is time consuming and difficult. Even with the advent of knot pushers and suture grabbers, it is still difficult for the surgeons to quickly tie arthroscopic knots. Thus, it would be a significant contribution to the art to provide a device that would replace suture knots in arthroscopic surgical procedures.

### Summary of the Invention

We have discovered a one-way adjustable suture retaining device suitable for use in arthroscopic surgery to secure one end of a braided suture, wherein the device comprises a frustum having an end and a base wherein a passage extends from the end to the base and the end has a plurality of slits extending from the end towards the base defining at least one flexible fingers.

### DESCRIPTION OF THE DRAWINGS

FIG.1 is a perspective view of the suture retaining device engaged about a braided suture.

FIG.2 is a frontal view of the suture retaining device.

### DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 1 the one-way adjustable suture retaining device is a frustum having an end 4 and a base 6. Connecting the end 4 to the base 6 is passage 8 which is substantially concentric about center line 10 which extends from the center of the base 6 to the center of the end 4. The end 4 has at least two slits 12 and 14 which extends generally from the end toward the base. Preferably end 4 will have four slits, 12, 14, 16 and 18, which define fingers 20, 22, 24 and 26 respectively, as shown in FIG.2. The fingers 20, 22, 24 and 26 preferably have points 20a, 22a, 24a and 26a, which are adapted to engage braided suture 28 such that the suture cannot be

advanced from the end 4 towards the base 6, but can be advanced from the base 6 toward the end 4 because of the flexibility of fingers 20, 22, 24, and 26. The suture retaining device should have a passage 8 of a sufficient diameter to allow a braided suture to easily pass through passage 8, but small enough to allow flexible fingers 20, 22, 24 and 26 to engage the braid when a suture in the passage 8 is moved towards the base 6.

In a procedure, to secure one end of a suture, the suture would be passed through part of the tissue to be secured, then the suture would be passed through the passage 8 of the suture retaining device. The suture retaining device would be oriented on the suture so that the base would contact the tissue when advanced on the suture toward the tissue. The retaining device would be slid down the suture until the base contacted the tissue. Next the surgeon would pull the suture tight approximating the tissue together. As the surgeon progresses, he may use another suture retaining device to secure the other end of the suture thereby securing both ends of the suture. Preferably, the ends of the suture to which the suture knot retaining device are to be placed would have a simple knot tied in them to avoid the suture unravelling, thereby releasing the grip of the suture knot retaining device.

The retaining device of the invention can be made of any biocompatible material using conventional fabrication methods. The retaining device can be composed of various biocompatible metals, e.g. titanium, stainless steel, and tantalum, and polymeric materials. Preferred are bioabsorbable polymeric materials include but are not limited to aliphatic polyesters selected from the group consisting of homopolymers of epsilon-caprolactone, glycolide, lactide (including d, l, dl and meso) and para-dioxanone and copolymers of at least two thereof. Preferred non-absorbable polymers include but are not limited to materials selected from the group consisting of nylons, polyesters and polypropylene. All these materials have been demonstrated to be biologically acceptable when used as sutures or other implantable medical devices.

The preferred means for fabricating the retaining device from polymeric materials is to inject a polymer melt into an appropriately designed mold at process conditions conventionally employed for injection molding such polymer systems. After the polymer melt cools, the molded retaining device can be readily released from the mold, inspected, packaged and sterilized.

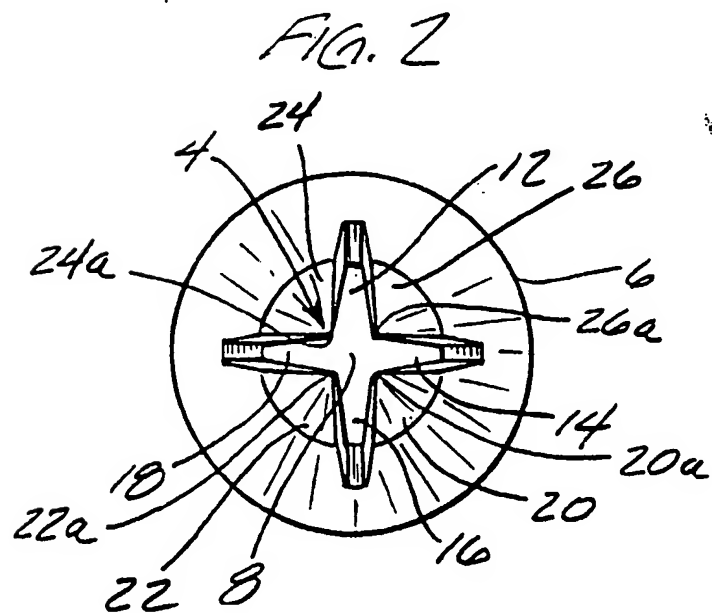
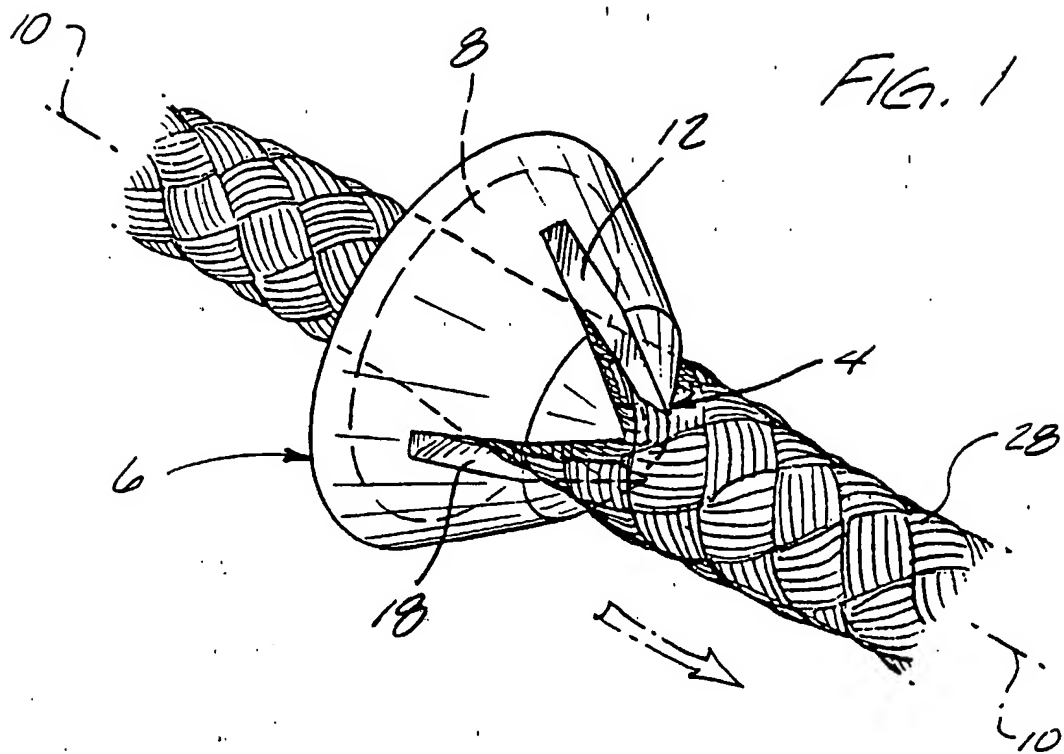
The retaining device may be sterilized by any of the well known sterilization techniques. The technique selected will depend to a great extent on the material used to make the retaining device. Suitable sterilization techniques include heat or steam sterilization, radiation sterilization (such as cobalt irradiation or electron beam), ethylene oxide, and other sterilization techniques well known in the art.

Having now described the present invention and certain specific embodiments thereof, it will be readily

apparent to those skilled in the art that many variations and modifications may be made to the present invention without departing from the spirit and scope thereof.

#### Claims

1. A sterile one-way adjustable suture retaining device suitable for use in arthroscopic surgery to secure a braided suture comprising a frustum having an end and a base wherein a passage extends from the end to the base and the end has a plurality of slits extending from the end towards the base defining at least one flexible fingers.
2. The sterile retaining device of claim 1 wherein the retain device has four flexible fingers.
3. The sterile retaining device of claim 1 wherein a sterile braided suture is present in the passage.
4. The sterile retaining device of claim 1 wherein the suture retaining device is made of a biocompatible material selected from the group consisting of titanium, tantalum, homopolymers of  $\epsilon$ -caprolactone, homopolymers of glycolide, homopolymers of lactide, homopolymers of p-dioxanone, copolymers of  $\epsilon$ -caprolactone, copolymers of glycolide, copolymers of lactide and copolymers of p-dioxanone.
5. A process for securing one end of a suture that has been passed through a tissue relative to the tissue comprising placing a sterile one-way adjustable suture retaining device composed of a frustum having an end and a base wherein a passage extends from the end to the base and the end has a plurality of slits extending from the first end towards the base defining at least two flexible fingers, on the suture with the base oriented toward the tissue and advancing the suture retaining device relative to the suture by passing the suture through the passage from the base to the end until the base contacts the tissue.





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(54) **One-way suture retaining device for braided sutures**

(57) A one-way adjustable suture retaining device suitable for use in arthroscopic surgery to secure one end of a braided suture (28) comprising a frustum having an end (4) and a base (6) wherein a passage (8) extends

from the end (4) to the base (6) and the end (4) has a plurality of slits (12,14,16,18) extending from the end (4) towards the base (6) defining at least two flexible fingers (20,22,24,26) and a process for using the retaining device to secure at least one end of a suture (28).

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# PARTIAL EUROPEAN SEARCH REPORT

Application Number

which under Rule 45 of the European Patent Convention EP 96 30 5501 shall be considered, for the purposes of subsequent proceedings, as the European search report

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category   | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim   | CLASSIFICATION OF THE APPLICATION (Int.Cl.6) |
|--|---|---|--|
| X  | US 5 391 173 A (WILK)   | 1,3   | A61B17/04                                    |
| Y  | * column 3, line 50 - column 4, line 2 *                                      | 2,4   | A61L31/00                                    |
|  | * column 5, line 10 - line 28; figures 1,2D,4,7,8 *                           |   | A61F2/08                                     |
| Y  | EP 0 591 991 A (UNITED STATES SURGICAL CORPORATION)                           | 2,4   |  |
| A  | * column 4, line 33 - column 5, line 7; claim 13; figures *                   | 1,3   |  |
| A  | US 5 413 585 A (PAGEDAS)  | 1,3   |  |
|  | * abstract; figures 1,2,4 *   |   |  |
| A  | EP 0 634 142 A (ETHICON)  | 4   |  |
|  | * column 5, line 4 - line 15 *  |   |  |
| A  | US 5 258 015 A (LI)   |   |  |
| A  | WO 95 16398 A (ETHICON)   |   |  |
|  |   |   | TECHNICAL FIELDS SEARCHED (Int.Cl.4)         |
|  |   |   | A61B   |
| INCOMPLETE SEARCH  |   |   |  |
| <p>The Search Division considers that the present European patent application does not comply with the provisions of the European Patent Convention to such an extent that it is not possible to carry out a meaningful search into the state of the art on the basis of some of the claims.</p> <p>Claims searched completely :</p> <p>Claims searched incompletely :</p> <p>Claims not searched :</p> <p>Reason for the limitation of the search:</p> <p>see sheet C</p> |   |   |  |
| Place of search  |   | Date of completion of the search  | Examiner                                     |
| THE HAGUE  |   | 10 July 1997  | Klein, C                                     |
| CATEGORY OF CITED DOCUMENTS  |   | <p>T : theory or principle underlying the invention</p> <p>E : earlier patent document, but published on, or after the filing date</p> <p>D : document cited in the application</p> <p>L : document cited for other reasons</p> <p>&amp; : member of the same patent family, corresponding document</p> |  |
| <p>X : particularly relevant if taken alone</p> <p>Y : particularly relevant if combined with another document of the same category</p> <p>A : technological background</p> <p>O : non-written disclosure</p> <p>P : intermediate document</p>   |   |   |  |



European Patent Office

EP 96305501 - C -

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**INCOMPLETE SEARCH**

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The Search Division considers that the present European patent application does not comply with the provisions of the European Patent Convention to such an extent that it is not possible to carry out a meaningful search into the state of the art on the basis of some of the claims.

Claims searched completely: 1-4

Claims searched incompletely:

Claims not searched: 5

Reason for the limitation of the search:

(Art. 52.4 EPC)

Method for treatment of the human body by surgery.